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GUIDELINES FOR INVESTIGATING FISH KILLS

Montana Department of Fish,
Wildlife and Parks

Montana Department of Health
and Environmental Sciences

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Introduction

The chances of determining the cause of a given fish kill decrease rapidly with time. Evidence disappears quickly and may be gone in a few days or less. Investigation delays are often the result of timelag in reporting. Either the fish kill went unnoticed for a period of time or the individual who observed the kill failed to report it immediately. Additional unavoidable delays result because of the time it takes to prepare sampling gear and to travel to the site. Because of the importance of time in determining the cause, we should make every attempt to respond as soon as possible.

To be consistent in our response to fishkills, the following notification protocol and investigative procedures are suggested.

Notification

If at all possible, the Pollution Control Biologist should participate in, or coordinate all fish kill investigations. Upon learning of a fish kill, regional staff should immediately notify the Pollution Control Biologist (444-2406). If no one is available, regional staff should notify, in order of preference, Al Wipperman, Larry Peterman, or Steve McMullin.

Helena staff will notify appropriate individuals in the Water QuaTity Bureau, Department of Health and Environmental Sciences (Kevin Keenan, 444-2406) and Pesticide Management Division, Department of Agriculture (Steve Baril, 444-5613). These agencies must be involved in the investigation because they have the authority to take legal action against a responsible party.

Investigation Procedures

Fish kills are not particularly difficult to investigate nor do they require an unusual amount of technical expertise. The primary objective of any fish kill investigation is to determine the cause. Following is a list of types of information collected or activities conducted during most fish kill investigations:

(1) Chemical and physical characteristics of water -- Water samples should be collected during every fish kill investigation. Although the toxic agent is often gone by the time investigators reach the site of a fish kill, water samples may provide valuable evidence. Use your best judgement as to what type of sample to take depending on what you suspect caused the kill, e.g., metals, pesticides, oil, etc. If you are not sure, take samples for metals, pesticides and common ions. Refer to the attached guidelines for proper handling and preservation of different types of samples and for chain of custody procedures. If the suspected toxic agent is still entering the stream, samples should be taken above and below the discharge point and from the discharge itself. Follow proper chain of custody procedures and complete a chain of custody form. Store samples in a refrigerator (locked if the sample is to be used as evidence in legal proceedings) until they can be transferred to a laboratory.

Most regions have equipment to measure dissolved oxygen present in water. Oxygen measurements should be made if low oxygen is suspected as the probable cause or a contributing factor. Water temperature

should always be measured. If the kill occurred below a dam, measurements should be made of saturation of dissolved gases using a saturometer.

In most cases the material that caused the kill will be many miles downstream by the time you arrive. If you know the approximate time the kill occurred, estimate how far downstream the material has moved (most rivers and streams move at from 1-3 mph) and take a sample at that point. Be sure the sample is properly labeled (see sample collection procedures).

Fish kills in lakes may be caused by blooms of toxic algae. Toxic algae blooms often appear as "pea soup", green latex paint, or grass clippings. If a bloom fits the above description, collect a sample and ship it as soon as possible to Loren Bahls, Water Quality Bureau, who will determine if it is a potentially toxic species. Check shoreline areas for dead animals in the vicinity of the bloom. Follow-up bioassays using mice or Ceriodaphnia could be used to ascertain toxicity.

(2) Chemical characteristics of sediment -- Some pesticides and also metals tend to accumulate in stream sediments. In general, finer-sized freshly-deposited sediment should be collected above and within the fish kill location. If pesticides are suspected, the sample should be stored in a glass jar. A plastic bag will suffice if the sample is to be analyzed for metals only. Again, careful labeling is

a necessity. Include the time, date, and location from when the sample was taken and any other information that may be useful.

(3) Residues in fish tissue -- Some chemicals have a tendency to accumulate in fish tissue. Dead fish (preferably freshly dead) should be collected, wrapped in aluminum foil, placed in a plastic bag, labeled and frozen. A decision will be made later as to what to analyze for or whether to conduct analyses.

(4) Histological changes in tissues -- Some chemicals cause lesions on gills or other organs that are characteristic of being caused by a particular chemical or category of chemical. For example, following a kill in Big Spring Creek near Lewistown, histological preparations of fish gills showed evidence that the fish were exposed to a caustic material. This evidence supported our suspicion that the kill was caused by a discharge of anhydrous ammonia.

Histological samples must be taken from living fish. Decomposition of dead tissue masks tissue damage that may have been caused by the toxicant. If sick or dying fish cannot be readily collected, live specimens should be collected by electrofishing or netting. Both gill and liver tissue should be taken and immediately preserved in Bouin's solution -- each region previously received a jar of Bouin's solution (additional Bouin's solution can usually be obtained from the pathology department of your local hospital). Packing too much tissue into sample containers prevents some surfaces of the tissue from being properly preserved. Therefore, the volume of tissue should not exceed

1/10 the volume of Bouin's solution. Arrangements should be made to send preserved tissue to Charlie Smith, U.S. Fish and Wildlife Service, Bozeman (587-9265) for histological testing.

(5) Visual symptoms present on fish -- Note and record any unusual symptoms exhibited by the fish. For example, fish killed by metals often have a precipitate present on the gills. Some fish diseases causes characteristic symptoms. Photographs should be taken of fish exhibiting unusual symptoms.

(6) Visual observations at streamside -- Often the best tool for determining the cause of a fish kill is a thorough investigation of the river banks, particularly near the upstream boundary of the kill. Pipes, ditches, flumes or other structures may suggest the source of the toxicant. In the Racetrack Creek fish kill a leaky irrigation flume that crossed the creek near the upper limit of the kill suggested that an aquatic herbicide was responsible. Electroshocking confirmed that fish were present above the flume but nearly absent below.

Take photographs of any visual evidence and keep notes of the entire investigation including the time of day that various elements of the investigation are conducted. Later, you may be asked to fill out an affidavit that will be used in legal proceedings.

(7) Interviews with local observers -- Interviews often provide leads concerning the cause of a particular fish kill. Ask the person(s) who

reported the kill to describe what they observed and when. Others who live along the stream may have seen or heard something that may help to identify the cause. For example, a woman living downstream of a small tributary to the Musselshell River recalled that the creek had a strange septic odor the day the kill was reported. She also reported that a Hutterite colony located upstream of her home had several sewage oxidation lagoons. Discharge from these lagoons proved to be the cause of the kill.

Notes should be taken of all interviews including full names, phone numbers and mailing addresses of persons interviewed. Investigators may need to get back in touch with these people to ask additional questions or to request a signed affidavit for use in a resulting legal action.

(8) Estimation of the number and sizes of fish killed -- Once the cause of a fish kill has been determined, an effort should be made to estimate the numbers, sizes, and species of fish killed. This may be useful at some point in the future in trying to recover damages, particularly if the kill was caused by a pesticide (the Pesticides Act has a provision for recovering damages). Keep in mind, however, that these estimates are only useful if first it is known what killed the fish.

Estimates can be obtained: (1) by direct counting in small streams; (2) by making population estimates above and below the point the toxicant entered the stream and estimating the length of the affected

stream reach; (3) by re-estimating the population size if the kill occurred in a reach where recent fish population data exists.

Other hints -- Never trespass during a fish kill investigation, particularly on the property of a possible responsible party. Generally, evidence collected during a trespass situation is not admissible in court. Investigators should present identification, state their purpose, and secure permission from the property owner to conduct an inspection. Should you be denied what you judge to be critical access, local law enforcement personnel may be able to assist you.

Prepare a thorough report detailing each fish kill investigation. If the Pollution Control Biologist has not participated in the investigation, a copy of the investigation report should be sent to the Pollution Control Biologist. A central file is kept in Helena documenting all fish kills. This information is used in an annual report prepared by the Environmental Protection Agency.

Fish Kill Investigation Equipment List

Waders.

Equipment for collecting live fish (shocking unit, nets).

Equipment for measuring dissolved oxygen and water temperature.

Sample bottles and preservatives for collecting water samples.

Plastic bags, aluminum foil and jars for preserving sediment samples.

Disecting equipment and Bouin's solution for preserving organs for histological examination.

Notebook for keeping a log of the investigation and for recording interviews.

Pens, pencils and a waterproof marker.

Camera and film.

Saturometer (if below a dam).

Cooler and ice for storing water, sediment and fish samples.

Chain-of-custody forms.

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Recommendations for Collection and Preservation of Water Quality Samples

Collection of Sample

Take samples both upstream and downstream of the suspected source of pollution when dealing with flowing waters. The sample taken downstream from the source of pollution should be collected far enough below the spill or discharge to allow mixing of the pollutant in the water. This should require at least two 90 degree turns in opposite directions or 100 yards in very small streams. If possible, also obtain a sample of the discharge.

Rinse sample containers at least 3 times with the water being collected before filling and preserving (not applicable for pesticides, oil and grease, or organics). Label the container with the date, preservative used (if any), time of day the samples were taken and an accurate description of the sample site. If you have a map of the location, mark the sample site on the map.

Preservation of Sample

Types of containers, methods of preservation and maximum allowable holding time of samples are listed in the accompanying table. Samples with holding times less than 48 hours require prior notification of the Department of Health and Environmental Sciences, Chemistry Laboratory (444-2642).

Transferral of Sample

When collecting samples in situations where results may be used as evidence in legal proceedings, chain of custody procedures must be followed. A sample is under custody if it is in your possession or it was in your possession and then was locked or sealed to prevent tampering. Chain of custody forms must be filled out and samples locked in a mailing container or cooler before shipping. Before shipping chain of custody samples, please notify the Department of Fish, Wildlife and Parks, Water Pollution Control Office at 444-2406 or 444-5299.

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Recommendations for Collection and Preservation
of Water Quality Samples

Measurement	Container	Preservative	Holding time
Metals	Plastic 100 ml	Nitric Acid (HNO_3)	6 months
Nutrients (Nitrogen Phosphorous)	Plastic 1000 ml	Sulfuric Acid (H_2SO_4 1+1) Cool to 4° C	28 days
Total suspended solids	Glass or plastic 500 ml wide mouth	Cool	7 days
Turbidity	Plastic 100 ml	Cool to 4° C	48 hours
Oil and Grease	Glass 1 quart, freon rinsed, Al foil lined lid	Sulfuric Acid (H_2SO_4 1+1) Cool to 4° C	28 days
Cyanide	Plastic 1000 ml (NaOH)	Sodium Hydroxide	14 days
Biological oxygen demand	Plastic 1000 ml	Cool to 4° C	48 hours
Fecal coliforms	Plastic 100 ml, sterile bottle with Sodium Thiosulfate	Cool to 4° C	6 hours
Common ions (Alk, Hrd, pH)	Plastic 1000 ml	None	Alk, Hrd - 24 hours pH - 6 hours (on site if possible)
Pesticides	Glass 1 gal, Acetone rinsed, teflon cap	None	14 days

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